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DEVELOPMENT STRATEGY FOR ENERGY BASE EXPLAINED

Shanghai SHIJIE JINGJI DAOBAO in Chinese 27 Apr 87 p 3

[Article by Xu Shoubo [1776 1108 3134]]

[Text] A Dual Social and Economic Role

China's energy base economic zone will have a dual-task. The first will be to build a large national economic gase, and the second will be to build a comprehensive economic development zone in which there is coordinated economic development and in which the people's livelihood progressively improves. Thus, this energy base has a dual social and economic role both inside and outside of the base. "Outside" refers to the export of a large amount of energy outside of the base (including exports to foreign countries). The traditional concept of the export of energy only involves the export of coal, but I feel that future exports from the energy base should include the following four types of energy: the first type (category-1 energy) is raw coal; category 2 is the raw material that comes from processed raw coal, including washed and refined coal, coke, coal gas and electricity; category-3 is high energy consumption raw materials that consume more than 1 ton of coal for each ton produced (such as steel, aluminum, calcium carbide, and ferro-alloys); category-4 commodities are the high energy consumption end products (such as machinery) manufactured from high energy consumption raw materials. Category-3 and category-4 resources are "concentrated" energy resources, and can save many times the transport volume compared to category-1 and category-2 resources. For example, transporting 1 ton of aluminum can save 9-10 tons of coal transport volume compared to category-1 and category-2 resources. Today, almost all of the energy base's exports are category-1 and category-2 energy resources. In the future the base must strive to ship out category-3 resources, and starting at the present must gradually implement dual planning and construction. The base must taken on technical and scientific research education and make preparations to have skilled personnel and technology in order to ship out category-4 resources in the future.

The "internal" role is to competently coordinate the development of the economic zone itself and to narrow the various long-standing gaps between

the energy base's level and the average national level. These external and internal roles cannot work against each other but rather must be mutually promoting.

Cross-Shaped Development Strategy

Based on the dual tasks and social and economic roles of the energy base, I feel that its development strategy should be "cross-shaped." This so-called "cross-shape" also has dual meanings. The first meaning is that we must build a cross-shaped economic structure in which an externally-oriented economy and inner-directed economy criss-cross. The second meaning refers to the criss-cross between the five key words of the externally-oriented economy (coal, electricity, metallurgy, chemicals, and machinery) and the five key words of the inner-directed economy (roads, construction, food, light [industry] and tertiary industry). It is certainly true that the externally-oriented economy mainly refers, although not exclusively, to all the different energy commodities that can be shipped out, and that it mainly serves the inner-directed economy. At the same time, the inner-directed economy serves the externally-oriented economy. The inner-directed economy mainly refers to the basic daily necessities (clothing, food, housing, transportation and the tertiary industries). The "roads" mentioned above refer to all the various types of transportation, and these are a necessary condition for both the inner-directed and externally-oriented economies. "Construction" refers to all the industries associated with housing and includes building materials, construction, etc. "Food" does not only refer to the food industry but also refers to the industries related to food, and includes agriculture. "Light" [industry] refers to all the industries related to clothing, including the textiles industry. Tertiary industries include education, culture, health, scientific research and service industries. These two economies should be mutually promoting and mutually developing.

A Development Management Style and Open Style

The energy base economic zone should not become a zone where energy resources are merely exploited but should have a development management style, and should mainly proceed from market demands and economic results. The energy base must be oriented toward three markets: domestic (refers to the energy resources commodities market outside of the energy base), international, and the energy base itself. The two former energy commodity markets are extremely important for China's enormous energy commodities bases, and in the final analysis, the development of the energy base depends on the demands and economic results of the domestic and international markets. To a large extent, the development of the inner-directed economy of the energy base itself depends on the base's market demands and economic results.

The energy base economic zone cannot become self-sufficient and closed, but must be built into an open zone in which different areas help supply each other's needs. Mainly, different types of energy commodities should be

shipped from the base, and funds, medium and high-level technology, equipment, grain and consumer goods should be brought into the base. We should not force the production of those consumer goods which do not yield good economic results. Everything should be looked at from the viewpoint of economic results.

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PLANS FOR NATIONAL ENERGY BASE BEGIN TO TAKE SHAPE

Shanghai SHIJIE JINGJI DAOBAO in Chinese 27 Apr 87 pp 1,3

[Article: "Plans for China's Energy Base Begin To Take Shape; China Expected To Be World's Largest Coal Producer by Year 2000"]

[Text] The development prospects for the year 2000 are already taking shape for China's enormous coal-oriented energy base located in the five provinces of the middle reaches of the Huang He. This significant event in China's power construction is attracting national as well as international attention.

According to statistics, the verified coal reserves in this energy base rank among the best in the world. The reserves are second only to those of the Appalachians. In addition to the easily extracted large reserves, this region also has such outstanding varieties of coal as "power" coal, coking coal, and anthracite. In addition, the base has abundant bauxite resources and has provided competitive conditions for the development of a comprehensive base comprised of coal-fired electricity, coal chemicals, metallurgy, non-ferrous metals, building materials, machinery, and the light and textile industries. It is forecast that by 2000, coal output will reach 600 to 700 million tons [per year], and that this area will become the world's largest energy base.

Since the State Council established the Energy Base Planning Office in 1982, a preliminary investigation was made into the micro-economic regional planning within the base. The base has decided to consider aluminum, coal, electricity, and other key construction projects as "group projects." These projects have been listed individually in the state investment plan to be comprehensively developed and simultaneously constructed. The comprehensive development of the Shenmu coal field in Shanxi Province and the Dongsheng coal field in Nei Mongol already comprises the Huaneng Jingmei Company's overall planned construction of coal, electricity, and transportation. Preparations are being made for the construction of the coal, electricity, and roads for Junggar in Nei Mongol. Railroad, highway and water transportation are being planned and organized in order to suit the new setup of transporting coal from west to east and from north to south, and of getting the coal to where it is needed.

Based on the energy base's development strategy of stretching from the east to the west, in the next decade (1990-2000) the foundation will be laid for large-scale development west of the Huang He in the 21st century. Thus, the planning office is considering adopting the following measures:

1. It plans to list the development of the energy base as a key construction area for national economic development in the next decade. Important smaller regions in the base and their corresponding key projects will be individually listed as group projects in the national plan. Under unified planning, other provinces will be encouraged to invest in jointly running mines and factories and in building roads. Funds will be raised in all forms and from all possible sources.

2. The energy base plans to support peasant-run mines. According to estimates, in the next decade the output from local and township mines will account for about half of the base's total output. The base will divide the mining resources and coordinate the production, transportation, and marketing arrangements to promote healthy development. In addition, in Jincheng the base is preparing to set up a joint exploitation, transportation, and marketing company for anthracite in order to find new ways to stimulate enterprises.

3. Turning coal into a secondary energy resource and developing the electric power industry is also a key development goal of the energy base. It advocates a policy of allowing those who invest to receive the power, and of having each region achieve a balance between power supply and demand. It will also progressively increase the transmission of electric power to the eastern coastal region.

4. In order to resolve the gap between construction and production, the energy base plans to unify investment, production and management, and especially will organize all types of joint economic entities. It will develop coal-fired electricity and the coal chemical and high energy consumption raw materials industries.

5. A special fixed pricing policy will be implemented within the plan. Township and town enterprise mines will have protected prices; there will be different prices for electricity inside of and outside of the energy base; favorable treatment will be given for the transport of coal by heavy-haulage dual-use rolling stock and ore will be brought in from ports using empty cars that originally had hauled coal eastward.

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RATIONAL PLAN FOR HIGH ENERGY CONSUMPTION INDUSTRIES

Shanghai SHIJIE JINGJI DAOBAO in Chinese 27 Apr 87 p 3

[Article by Liu Jingtong [0491 2529 1749]

[Text] In order to meet the needs of economic construction while encouraging localities, departments and enterprieşe to concentrate their efforts on setting up a raw and processed materials industry, it is imperative that proceed from China's actual energy and transportation situation and strengthen macroeconomic guidance. We should integrate the near- and far-term development of the raw and processed materials industry and rationalize its planning, and we should get even better results from limited financial, material, and human resources.

Consider the Possibility of Transportation Development

The raw and processed materials industry including the steel, nonferrous metal chemical and building materials industries, are all high energy consumption industries. The development of the raw and processed materials industry is subject to financial limitations and restrictions from other conditions, and energy and transportation will have a long-term effect on the production and management of enterprises.

Forecasts indicate that by the year 2000, the amount of coal transported out of the energy base will be three times the amount of 1985, and we must make enormous strides in order to transport several hundred million tons of coal. Improving the deployment of high energy consumption industries and working hard to relieve the pressure on the amount of coal transported from the west to the east are significant steps in the development of the national economy. If we do not consider the extent to which transportation can develop and continue to deploy high energy consumption raw materials industries in regions that lack energy resources, then not only will we further aggravate the irrational deployment of high energy consumption industries which are too concentrated in the eastern part of the country, but after reforming the current planned allocation system and opening up the energy and raw and processed materials markets, the high energy consumption industries in energy-deficient areas could fall into a troublesome situation in which it is difficult to continue [receiving] energy resources and raw and processed materials.

Breaking Through Some Traditional Concepts

In the past, China's steel industry was made up of only iron mines, and rarely were there both iron mines and energy resources. In recent years, we have also developed an experimental model in coastal locations using imported high-grade ore.

The current average amount of energy consumed per ton of steel produced by China's main steel enterprises is 2 standard tons of coal, which is equivalent to about 3 tons of raw coal, and concentrated iron [tie-jing-kuang] is 1.6 tons. From the viewpoint of China's national conditions, the positioning of the steel industry in an energy-producing region possess special significance. We should make full use of the energy base's advantageous coking coal and power coal, and adopt "pendulum" transportation, i.e., making use of the empty cars that have transported large amounts of coal to the east to ship iron ore. By using that area's abundant fuel and supplementary raw and processed materials to develop the steel industry's energy base can lighten the pressure on the transport of coal by rail to the east and raise the transport efficiency of the empty rail cars making the return trip. Moreover, it will help the development of the economies of the energy base's impoverished border regions, improve the layout of China's high energy consumption industries, and it will be of benefit to both enterprises and society. During the last 15 years of this century we must concentrate on the transformation and expansion of the energy base's steel industry. If state finances are sufficient we can also build a few medium-sized steel enterprises in the energy base or in the surrounding energy producing areas.

For a long time, the foreign model of having hydropower co-located with the aluminum industry has had a large influence on China. China's hydropower resources, however, are concentrated in the west, and hydropower's share in the total energy picture cannot increase very much for quite a long time. In addition, unlike Europe and the U.S., China's hydropower is greatly affected by yearly and seasonal droughts and abundant water supplies, and hydropower plays a feast-or-famine role in the power grids. In addition to seasonal electric power, hydropower's electricity prices are not low. Thus, a power-hungry consumer such as the aluminum industry needs many different models. In areas where hydropower is advantageous, we can locate the enterprises there, such as in the northwest, the southwest and Guangxi Province. Yet we must also fully consider the needs that the economic development of these places have toward hydropower, and locate enterprises appropriately. The key in using coal-fired electricity to develop aluminum is in how to lower production costs. During the restructuring of our economic system, we have all the conditions necessary to gain a better understanding of how to achieve a new integrated system of aluminum, electricity and coal.

The aluminum industries in the U.S., Canada, and Norway are fairly advanced, and they mainly make use of their superior energy resources, and import alumina resources to develop aluminum. China's energy base has the dual advantage of possessing hard-to-come-by energy and aluminum resources. In

1985, the base's verified bauxite reserves accounted for 60 percent of the nation's total, and this is an exceptional advantage. Current alumina output accounts for more than half of the national total, and the base's electrolytic smelting of aluminum accounts for 25 percent of the national total. The state has decided that during the Seventh Five-Year Plan, Jiaozuo in Henan Province will organize an aluminum-electricity-hydropower group project, and will use this to gradually develop a joint economic entity, and assume responsibility for its own profits and losses. This will constitute a significant reform in which construction, production and management are a unified, planned system.

As for China's petrochemical industry, the petrochemical and coalification industries both need to be developed. It seems even more imperative to develop a new generation of coalification [plants] represented by synthetic gas and methanol. We must actively prepare for this and as much as possible realize a transformation of energy resources in the Energy Base itself.

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GANSU STRESSES LONG-TERM POWER CONSERVATION

HK300317 Lanzhou Gansu Provincial Service in Mandarin 2200 GMT 29 Jul 87

[Excerpts] A provincial conference on the planned and economical consumption of electric power, which concluded on 29 July, pointed out that there will be no easing of the current electricity shortage in the province for a very long time to come and the industry and communications enterprises and the departments concerned must fully understand this issue and truly shift their stand to planned and economical power consumption. They must regard this work as a major affair in the double increase and double economy drive and get a thoroughly good grasp of it.

The meeting held that the main reasons for the marked contradiction between supply and demand of electricity in Gansu are: The development of the electric power industry does not match the national economic growth rate; the current industrial structure does not match the development of the electric power industry; and the electric power industry does not match the current construction scale of high power-consuming industries. And large sums of capital and a very long time are needed to resolve these problems. Hence, doing a good job in the planned and economic consumption of electricity is an effective way of solving the province's power shortage for some time to come.

Vice Governor Zhang Wule said at the meeting: In the future we must do a good job in the careful allocation and optimum operation of hydroelectricity, and of the full generation and supply of the thermal power facilities, together with their safe operation. We must reduce leakage in power transmission lines and step up the ideological building of the workforce and improve services.

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BRIEFS

SHANDONG POWER GENERATION--As of 26 June, the Shandong Power Grid generated a total of 14.6 billion kWh of electricity, an increase of 8.8 percent over the same period of last year, overfulfilling the semi-annual power generation plan five days ahead of schedule. The rate of coal consumption used in power generation, power line damage, and other production and consumption targets showed a marked decline from the same period of last year. Some 42,000 tons of standard coal and 57 million kWh of electricity were saved. [Text] [Jinan Shandong Provincial Service in Mandarin 2200 GMT 25 Jun 87 SK] /12913

SHANXI POWER OUTPUT UP--Beijing, 9 Jul (XINHUA)--North China's Shanxi Province registered a 28.5 percent increase in its power output in the first half of this year, ranking first nationwide, today's PEOPLE'S DAILY reported. China's key coal production base, Shanxi feeds power to Beijing, Tianjin, and Hebei Province, and doubled supply to these three areas in the 6 months to reach 2,755 million kWh. The paper attributed the growth to the introduction of the economic responsibility system in the province's power production units. The Shentou power plant and the Datong No 2 power plant, Shanxi's two major power producers, turned out a total of 5,473 million kWh of electricity from January to June, 87.7 percent more than the same 1986 period. [Text] [Beijing XINHUA in English 0809 GMT 9 Jul 87 OW] /6662

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STATUS AND TRENDS OF HYDROELECTRIC EQUIPMENT MANUFACTURING TECHNOLOGY IN CHINA

Harbin DADIANJI JISHU [LARGE ELECTRIC MACHINES AND HYDRAULIC TURBINES] in Chinese No 5, Sep 86 pp 1-5

[Article by Qu Shuzeng [2575 6615 2582] of the Ministry of Machine-Building Industry's Harbin Large Electrical Machinery Research Institute: "Status and Development Trends of Hydroelectric Equipment Manufacturing Technology in China"]

[Excerpts] 1. Introduction

Hydroelectricity is an inexpensive, renewable resource. It does not expend fuel, and it does not generate pollution. In the industrially advanced nations, there are efforts to develop hydroelectricity first, in order to preserve underground resources. In such countries as Norway, Switzerland, and Japan, over 60 percent of the water resources have been developed. In some nations, Norway, Switzerland, and Brazil, for example, the figure approaches or surpasses 90 percent. The pace of hydroelectric development has been very rapid in recent years, with 600 and 700-megawatt (MW) units emerging one after another. The capacities of high-speed generators have also been getting larger and, along with the needs of load regulation, more and more units are being produced with reserve capabilities. Hydroelectricity has now entered an era of large capacity and multiple variety.

China is a nation with abundant water resources. The country's total reserves are about 600-gigawatts (GW), of which about 380 GW can be developed. By the end of 1985, the total installed capacity nationally was only about 25 GW, just 6 to 7 percent of the potential development. So it can be said that there is a bright future for the development of hydroelectric resources in China.

2. The Status of Hydroelectric Equipment Manufacturing Technology in China

Prior to liberation, China was incapable of producing hydroelectric equipment. In 1951, the first 800-kilowatt (kW) hydroelectric unit was designed and produced in China. Today, there are a group of Chinese-designed and produced stations in operation with a per-unit capacity of 300 MW. Stations having 320 MW per-unit capacity will soon be in operation. China's production of hydroelectric equipment has taken a leap forward, not just in capacity, variety, and quality, but in annual output as well (Table 1).

Table 1. Types and Capacities of Hydroelectric Stations Made in China

Generator Type	Power Station	Per-Unit Capacity (MW)	Design Head (m)	Turbine Diameter (m)	Rotating Speed (rpm)	Manufacturing Plant	Initial Year of Operation	Remarks
Mixed-flow	Xin'an Jiang	72.5	73	4.1	150	Harbin	1959	
	Yunfeng	100	89	4.1	150	Harbin	1965	
	Liujiaxia	225	100	5.5	125	Harbin	1969	
	Liujiaxia	300	100	5.5	125	Harbin	1973	Generator totally water-cooled
	Danjiangkou	150	63.5	5.5	100	Dongfang	1970	
	Yuziqi	37(40)	270	2.1	500	Harbin	1972	
	Niaojiangdu	210	120	5.5	125	Dongfang	1974	
	Baishan	300	112	5.5	125	Harbin	1984	
	Longyangxia	320	120	6.0	125	Dongfang		
Axial-flow	Dahuofang	16	25.2	3.3	214.3	Harbin	1959	
	Qingtongxia	36	18	5.5	107	Harbin	1970	
	Fuchun Jiang	60	14.3	8.0	62.5	No. 12 Engineering Office	1972	
	Shimen	12.5	67	1.8	500	Harbin	1978	Max. peak flow is 78m
	Sanmenxia	50	30	6.0	100	Harbin	1975	
	Gezhouba	170	18.6	11.7	54.6	Dongfang	1981	Runner diameter is in world's front rank
	Gezhouba	125	18.6	10.2	62.5	Harbin	1981	" " " "
Axial-flow fixed blade	Hongshi	50	23.3	6.0	107	Harbin	1985	
Impulse	Baizhangji	12.5	345	1.46	500	Harbin	1960	
	Mofanggou	12.5	458	1.70	500	Harbin	1969	
Linked-flow	Baigou	10	6.2	5.5	78.9	Tianfa	1985	
Diagonal flow	Miyun	11/15	44/52	2.5	250/273	Tianfa	1971	Subordinate storage unit
	Maojiacun	8	58	1.6	428.6	Harbin	1971	

To summarize, it may be said that China has gone from being a "have-not" to a "have," from small scale to large; but while able to satisfy its own developmental needs, China is still far from being an exporter. Some projects have attained world standards, and some have reached the advanced world's standard.

China's production of hydroelectric units is characterized by the following:

A. Hydraulic Turbines

China has produced a variety of hydraulic turbines: mixed-flow, axial-flow, axial-flow fixed blade, impulse, diagonal flow, and linked-flow types. Of these, the axial-flow hydraulic turbines at Gezhouba are rated at 170 MW and 125 MW, with turning diameters of 11.3 m and 10.2 m, respectively. Not only the dimensions, but the manufacturing technology and ability are in the world's front rank as well. The Shimen axial-flow hydraulic turbine's maximum head is 78 m, which can also be considered up to the world's standard. This is the basis which China has adopted for its future production of high-head, large-capacity, axial-flow turbines.

At the beginning of the 1950's, the runners used in China's turbines were U.S.-made. By the end of that decade, Soviet-made runners were used. China began to produce its own at the start of the 1960's. From 1973, China's own reaction-type hydraulic turbine runner system began to see wider use. Our job now is to develop runners which approach or catch up to the world's level of advancement. This would satisfy the needs of building the national economy. To do this, China's first high-head hydroelectric experimental station, which was appraised in 1984 at the Harbin Large Electrical Machinery Research Institute, has now gone into operation. Today, there are several high-head experimental stations in the process of installation and adjustment. Looking at the present situation, we see that in the area of large-capacity, mixed-flow hydraulic turbine model runners, by increasing the revolving speed to a degree approaching world class, it is possible to cut down the discrepancy in this model's efficiency rate (when compared to other nations) from its present 2 or 3 percent to less than 1 percent. This kind of trend demonstrates that by sustained effort it is entirely possible for Chinese model runners to attain the world's advanced levels.

China has produced wholly forged, mixed-flow runners having diameters of less than 4.1 m, as well as runners cast in two parts of 5.5 and 6.0 m diameters, and welded composite runners. These runners can meet transportation requirements.

The materials used in the runners range from a complete use of 20SiMn steel to a combination of 0Cr13Ni4 and 6Mo rustproof steel. The technology program ranges from casting through welding. The 20SiMn and the rustproof steel runners employ different kinds of welding. We now have nearly 15 years of operational experience with these, which has produced China's unique and different kind of welded runners and their technology.

In the structure of the runners, both the butterfly and the parallel types of [side ring] are used. We have also obtained data on their operational

capabilities. In large capacity units there is now machining and operational experience with ring and vibrational relays. We are producing butterfly valves with diameters of 5.3 m, and ball valves 1.6 m in diameter. The former are used for a head of 110 m, the latter at 320 m. Self-lubricating plastic daoye [guide vane] axle sleeves have been put into application, replacing the traditional tin and bronze sleeves. To prevent escape, guide vane self-closing research achievements have been applied, and in 35 station-years of operational experience, movement capabilities have been excellent. There is reliable experiential data on the section's shutter installation. There has been continual improvement and perfection in composition, which in turn have continually improved the hydraulic turbines' manufacturing quality and operational capabilities.

Axial-flow blade buffing technology has gotten the blades' smooth finish to V 7 of blueprint specifications. It uses double vortex milling action in a guide vane journal, with a deviation in its eccentric circles as small as 0.12mm from specifications. This installation and technology are up to international standards.

B. Hydroelectric Generators

Due to the limitations put on them by low rotating speeds, some large-capacity hydroelectric generators have been made with stators having increasingly large-diameter iron cores. But large-diameter iron cores and their housings bring with them problems of heat expansion. Severe heat expansion can cause the stator's iron core to buckle, even to the point of being flexible. This problem had drawn considerable attention. China has produced some large-diameter hydroelectric generators. For example, the Gezhouba power station's 170 MW generator has a 17-meter internal diameter stator iron core, with a 20-meter external diameter housing. The 125 MW generator has a 15-meter internal diameter iron core, and a 17.7-meter external diameter housing. The former is 1 meter larger than the Itaipu power station unit's stator iron core, while the latter is 1.35 meters larger than that of the Guri II power station's. However, in composition our adoption of certain measures led to the problems' resolution. The units are operating normally. At Liujiaxia power station, a generator having an 11.75-meter iron core and a housing of 14.35 meters external diameter is used, and it has been operating normally since it first went into operation in 1969.

In the composition of thrust bearings, China's thrust bearing loads of less than 1,000t are basically using rigid props, with a per-unit pressure of approximately 40 kgf/cm^2. This assures safe operation. Loads in excess of 1,000t basically all use hydraulic props. This raises the per-unit pressure to 56 kgf/cm^2. Today, only the 600 MW unit at the Grand Coulee III hydroelectric plant has a higher thrust load and per-unit pressure than does China's. This type of composition can cut the uneven distribution among loads to less than 3 percent, as well as bringing the average temperature deviation to within 1° to 3°C. There has also been successful application of thrust bearings greater than 3,300t. In addition, operational data has been obtained in simulated tests of units at thrust bearings of 3,800t. The Gezhouba thrust loads are 3,300t and 3,800t. This is second only to the

thrust loads of Grand Coulee III and Itaipu, and is up to the world's standard.

The majority of the hydroelectric generators produced in China are of the suspension type, with a lesser number being of the umbrella type. However, in large capacity units China's suspension and umbrella type units have a common characteristic: according to calculations, they definitely cancel out guide bearings. When this happens, the suspension-type units can cancel out the chassis. The umbrella type unit can have the thrust bearing at the turbine header, which not only raises the unit's technological and economic quotas, but can also cut down on the amount of work involved in production, installation and operational safeguards. This is characteristic of the composition of China's hydroelectric generators. These are commonly used at the Xin'an Jiang station, at the Liujiaxia unit, and the large and small units at Gezhouba. This is completely different in composition from the guide bearings and load frames in use at such hydroelectric stations at Grand Coulee, Itaipu and Guri.

As for insulation, China began using Grade B insulation in 1964, and its application was widespread by the end of that decade. By the end of the 1970's China had successfully developed insulation that was Grade F in composition. From the beginning of this decade, it has gone from testing to application in large-scale hydroelectric and thermionic generators. The design's temperature rise is still based on Grade B, to increase the useful life of the unit. China got a relatively late start on this type of research, but in application, we are now basically in sync with the rest of the world.

In regard to ventilating and cooling systems, research has all along been concerned with solving the problem of temperature fall-off along the axis of long stator iron cores, and the fairly large temperature deviations there. The initial steps in research were to eliminate the fans and to decrease the end section vortex flow; this lowered the amount of wear and raised the generator's efficiency rate. These research results and improvements in ventilator construction have been successfully applied in 300 MW generators with excellent results.

In types of cooling, China took the lead at the end of the 1950's in developing a single unit, all water-cooled 10 MW hydroelectric generator. Continuing into the 1960's, it developed a single unit 72.5 MW and a 300 MW hydroelectric generator that were both totally water-cooled. These units are all operating normally. China also successfully applied freon cooling technology from 650 kW units to the stator coil of 10 MW units. The units' operational situation is excellent, with an average stator coil temperature of 59°C. They have passed technical evaluation. This may also open a new path in the type of cooling used in hydroelectric generators.

China has had some successful experimental results in the braking of hydroelectric generators, and these are now being put to use.

As for technology, in order to resolve the flexibility problem, especially that which the long iron core stator's iron core is subject to after a short

period of operation, there have been successful experiments with a new technology for hot pressing the iron core. This has obtained excellent results. At present, many manufacturing plants are putting it into application.

One effective measure for raising the quality of the generator's installed pressure as well as meeting transport requirements has been to install the stator iron core at the building site. China has successfully applied this measure to the 300 MW unit at the Baishan power station and the Dahua power station's 100 MW unit. In this regard, all large units installed during the past several years have been made this way, e.g., the Grand Coulee, Itaipu, and Guri hydroelectric stations. Those which have been different are those in China which have the housing dowel plate in one unit at the construction site, and those foreign units in which a multiple housing is welded into one whole unit at the construction site.

C. Auxiliary Sets

From the earliest dc electrical excitation system to the latest self-exciting systems, China has fully mastered the design, manufacture, installation, and operational maintenance of about six or seven types of excitation systems. This is especially so with automatic voltage governors. These are used in Liujiaxia and Sanmenxi power stations' KGT-type transistorized regulators, and are comparable to 1960's standards. The BJJ-I type integrated circuit regulators used in the Bapanxia, Gezhouba, Baishan, and Longyangxia power stations are approximately at the level of the 1970's. There is really no difference from other nations in the variety of and principles used in Chinese excitation systems. But more work is needed in the area of quality and reliability of basic parts.

In accordance with the realities of China's situation, research is still going ahead on regulator capabilities appropriate to the needs of high altitude and warm weather regions.

Research has been successful on the system stabilizer (PSS), and it is now in the process of industrial testing.

In the area of governors, the development of the main machinery brought with it some very great changes in governors as well. This was so from the production in the 1950's of the T-, ST-, and XT-series regulators, right through to the development in the 1960's of the electron tube and transistor type of dian ye governors. In the 1970's China moved forward in developing integrated circuit PID (Proportional, Integral, Differential) governors. These have been put into wide application in all new hydroelectric units produced in recent years. The level of oil pressure has been developed from 25 kgf/cm^2 to 40 kgf/cm^2. The volume of the oil pressure installation has been developed from 0.4 m^3 to 20 m^3, and moreover produced the automated components for corresponding levels of oil pressure. Today, China has experience with miniaturized governors for small-scale units. To my understanding, the only foreign instance of experience with miniaturized governors is at the ASEA Corporation in Sweden, with other companies at the stage of industrial testing.

3. Developmental Goals and Trends for China's Hydroelectric Stations in the Year 2000

At the end of 1980 the total installed capacity of China's hydroelectric equipment was 60,500 MW. Of this total, 16,870 MW represented medium and large-scale hydroelectric installations. If units smaller than 500 kW are included, then the latter figure is 20,300 MW. By the year 2000, China's total installed capacity of hydroelectricity will be 80,000 MW, an average annual increase of 3,000 MW.

The primary goal of our hydroelectric station efforts has all along been the raising of standards; the secondary goal has been to increase quantity.

When China's hydroelectric stations are compared to foreign standards, we see the following disparities:

In hydraulic turbines, the efficiency rates of China's various types of runners are in general lower than the world's advanced level; there has not been a breakthrough in the barrier caused by diameters larger than 6.3 meters being unable to transmit; working experience with linked-flow type runners has not led to their further development; storage-capable runners in application still have a low peak flow; cylindrical valve structure still is not in use, etc.

In hydroelectric generators, China has begun testing on disc-type rotor supports for intermediate units. The longest stator iron core is only 2.75 meters in length. The fire extinguishing systems in large units are all still water extinguishers here, while CO_2 extinguishers have been used abroad for a long time.

In auxiliaries, foreign nations are using a fuel tank pressure of 70 kgf/cm^2, while China is using 40 kgf/cm^2. Our corresponding automated components are also a grade lower. Foreign nations are using the PID (Proportional, Integral, Differential) governor in parallel connection, which makes for more stable parameters; China is using the PID in series connection, but has begun research on the parallel connection. Large-scale impulse turbine generators still await development.

In summary, China's hydroelectric stations are definitely behind nations in per-unit capacity, level of production technology and in the efficiency rate of manufacturing plant labor. If we are to develop China's hydroelectric industry, especially if we are to attain the goals for the year 2000, drawing upon the experiences of foreign nations, we should fulfill certain tasks in the following two areas:

In Planning and Policy:

a) Large, medium and small stations should be developed simultaneously, with emphasis on the medium and large stations;

b) We should import key technology for each project, to raise our technical level;

c) Design and manufacture of large units should have a firm domestic base.

In Industrial Management:

a) Speed up development of CAD/CAM applications;

b) Strengthen inspection measures, to control product quality;

c) Strengthen the background research work on products;

d) Continually raise product quality standards and the processes of standardization and interchangeability of parts.

12625/6091
CSO: 4013/14

BRIEFS

3000MW SICHUAN PROJECT--Chengdu, 26 Jul (XINHUA)--The State Council has decided to use international loans and international bidding for the construction of the country's largest power station, local power industry officials said here today. This project in Sichuan Province has been included in China's Seventh Five-Year Plan (1986-1990) with the approval of the State Council, the sources said. The dam of the project is 240 meters high and is said to be the third highest in the world today. The power station has a designed generating capacity of 3 million kilowatts and its annual power output will reach 16.2 billion kWh. About 70 percent of the country's hydropower resources is in southwest China, which includes Sichuan Province. [Excerpts] [Beijing XINHUA in English 0049 GMT 26 Jul 87 OW]

SOUTHWEST DEVELOPMENT PLANS--Today, Sichuan, Yunnan, Guizhou, and Guangxi province are building six large-scale hydroelectric power stations with installed capacities ranging from 510,000 kilowatts to 1.5 million kilowatts; total cost will approach 7.4 billion yuan. Work on the 1.5 million-kilowatt Manwan station in Yunnan began in October 1985, with construction of the main portion of the project beginning in May 1986. Water could be impounded as early as November 1987. The 1.2 million-kilowatt Yantan hydropower station on the Hongshui He in Guangxi Province could be finished a year ahead of schedule. [Excerpts] [Beijing RENMIN RIBAO in Chinese 6 Jun 87 p 1]

CSO: 4013/87

SHAJIAO B BEGINS GENERATING POWER

OW011652 Beijing XINHUA in English 1423 GMT 1 Jul 87

[Excerpts] Shenzhen, 1 July (XINHUA)--The largest thermal power plant in Guangdong Province, Shajiao B, went into operation in the Shenzhen special economic zone today.

Shajiao B with installed capacity of 700,000 kW is a joint venture between the mainland and Hong Kong's Hopewell Power (China) Ltd.

Its first generating set with a capacity of 350,000 kW has started commercial service, nine months earlier than the time set in the contract. The second generating set with the same capacity is expected to go into operation in September, also six months earlier.

The investment of this plant totalled 4 billion Hong Kong dollars, involving funds collected from 46 foreign banks. It is the largest joint venture power plant project in China.

It took only 22 months to complete the project, compared with the usual 3 years for similar projects, and its quality has been proved excellent.

The completion of Shajiao B will help to ease the power shortage in Guangdong. It is estimated that the province will create another 10 billion yuan of industrial output value annually if it has enough power supply. Due to short supply of power, many factories in Guangzhou operate under capacity.

According to the contract, the Chinese investor should buy electricity from the Hong Kong investor within the first 10 years of operation, then the plant will be owned by the Chinese side.

The equipment of this plant was imported from Japan.

/12913
CSO: 4010/64

BRIEFS

NEW SHANDONG 300MW UNIT--The 300,000-kW No. 1 generating unit of the Shiheng power plant, located in the western area of Feicheng County, was put into production on 30 June 6 months ahead of schedule. The generating unit, equipped with an automatic system, was jointly manufactured by more than 130 plants throughout the country, and which imported the advanced technologies from eight foreign countries, including the United States, Sweden, and Japan. The success in putting the new generating unit into production indicates that our country has joined the advanced ranks of thermoelectric power production in the world and has a vital bearing on the replacement and renewal of equipment in the country's power industry. [Summary] [Jinan Shandong Provincial Service in Mandarin 2200 GMT 30 Jun 87 SK] /12913

ZHANJIANG 600MW PLANT--Work has begun on the Zhanjiang coal-fired thermal power plant--the largest in western Guangdong Province. Approved by the State Planning Commission, the scale of this project is on the order of 600,000 kilowatts. Two 300,000-kilowatt coal-fired generator units will be installed at a total cost of more than 600 million yuan. After the two generator sets become operational, they will supply some 3.6 billion kilowatt-hours of electricity a year, or about 4 times the amount currently used in Zhanjiang. [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 19 Jun 87 p 1]

NEW NEI MONGGOL UNIT--A 100MW power generating unit has formally begun operation in the Wulashan power plant in the Nei Monggol Region. A ribbon-cutting ceremony was held on 27 July. The construction of this power generating unit began in May 1985 and was completed after 26 months. Its operation will play a role in alleviating the power shortage in the western part of the region. [Summary] [Hohhot Nei Monggol Regional Service in Mandarin 1000 GMT 27 Jul 87 SK]

/9716
CSO: 4013/88

CONFERENCE ADDRESSES PROBLEMS IN COAL QUALITY

Shijiazhuang HEBEI RIBAO in Chinese 7 Jun 87, p 1

[Article by staff correspondent Yang Jie [2799 2638] and staff reporter Wang Yulu [3769 5940 6922]: "Economic Losses Created by Poor Coal Quality Distressing -- The State Economic Commission, the Ministry of Transportation, the Ministry of Coal Industry, and the Ministry of Railways Jointly Call an On-Site Meeting on Coal Quality at the Port of Qinhuangdao. Formulations and Studies Were Made To Improve Measures and Methods.]

[Text] Presently, some of the coal freighted into the Port of Qinhuangdao has created a severe economic loss problem because the foreign matter in it has damaged many times the loading and unloading machinery and equipment of the port and of the consumers. This can no longer be ignored. From 4 June to today, the State Economic Commission, the Ministry of Transportation, the Ministry of Coal Industry, and the Ministry of Railroads has jointly called an on-site meeting on coal quality, and, after observing the coal loading and unloading operations on site at the port and an exhibition on transportation quality, the reasons for the existing problems were analyzed and studies and formulations were made to improve measures.

In recent years, in line with the first and second phases of the new automated coal port with large machinery mechanization going into production one after another, the Port of Qinhuangdao has, at present, already become China's largest port for energy exports. Its annual export capacity has already reached more than 40 million tons and is taking on the transfer duties for coal used in production and for living in 6 provinces and cities in the south and for foreign trade export coal. Due to the complete realization of mechanization and automation for coal loading and unloading at the port, using rotary dump cars for the whole train, a bucket-wheel to get the material, and a belt conveyor to load the ships, it is required that the coal coming to the port not have foreign matter mixed in. However, in recent years, foreign material in the coal trains coming into the port has continued, and, at present, more than 80 kinds have been discovered. Of these, there were 10 tons of iron slag, 2 tons of concrete pieces, 1 ton of iozite, more than 100 kilograms of rocks, and a 3-odd meter long piece of mine support wood as well as steel cable, rice straw, and other things forced down into the cars during loading. These foreign materials have many times brought about damage to the port's and consumers' loading and unloading machinery; workers have

been injured, causing production to be halted and effecting domestic coal transshipment and foreign trade exports. On 9 April this year, because of a large amount of rocks in the coal entering the port, 347 meters of a second-phase coal conveyor belt was torn up, causing the rotary dump line to halt production for 15 days. Not only were 590,000 fewer tons of coal dumped, but the sidings of each station on the railroad were overstocked with a large number of coal cars entering the port. Altogether, there are more than 12,000 meters of these kinds of conveyor belts in the whole set of equipment in the second phase of the new coal port, and now more than 3,000 meters of it has already been ripped. Because there has been foreign materials in the coal shipped out from the Port of Qinhuangdao, there have already been 18 machinery damage accidents at the Baogang Iron and Steel Complex in Shanghai with direct economic losses reaching more than 2 million yuan. In 1985 and 1986, because the coal quality of the foreign trade coal shipped to Japan from the Port of Qinhuangdao was poor, Japanese businesses for 130 shipping companies eventually brought forth damage claims for an amount reaching 85.70 million Japanese yen.

The more than 210 representatives from 103 mine and consumer, railroad, port and shipping units from six provinces, cities, and autonomous regions in the north of China participating in this on-site meeting visited the more than 280 tons of foreign material cleaned out during the loading and unloading of coal at the port and that brought back from foreign consumers on foreign ships, and they also visited a photo exhibition on coal transportation quality held by the Port of Qinhuangdao. During the discussions and analyses of these problems, everyone pointed out that it was truly distressing to look helplessly upon the damage by the foreign materials in the coal on the machinery and equipment at the modern coal port built with large amounts of foreign exchange spent by the State! In order to establish normal sequencing for coal production, transportation, and utilization and not bring about undue economic loss to the State again, after ample discussions, everyone decided to adopt measures to improve coal transportation quality as quickly as possible. First, they would enhance publicity and education to help the concerned units correct their business thinking and pay serious attention to improving coal quality. Second, they would clarify the quality standards and the responsibilities of each department. Third, they would implement a system of economic conditions for production and transportation quality, for, if the coal quality is not good and accidents are brought about, the responsible unit must compensate for the direct economic losses. Fourth, they would organize a mine, railroad, and port liaison group for coal transportation quality management, lead by the port and with liaison members established at each unit, and establish a small quality monitoring and examination group at the port with appointed representatives.

At this on-site meeting, the Qinhuangdao Port Administration Bureau, the Kailuan Mining Affairs Bureau, the Datong Division of the Shandong Provincial General Coal Transportation and Sales Company, the Jiangjiawan Coal Mine of Datong, Shanxi, the Zhangjiakou Regional Coal Industrial Company, and others separately introduced experiences and lessons started with themselves to enhance management systems and to improve coal quality.

13310
CSO: 4013/85

SHANXI NOW PRODUCING ONE-FOURTH OF NATION'S COAL

HK040326 Beijing RENMIN RIBAO in Chinese 28 Jun 87 p 1

[Report by Wang Aisheng (3769 5337 3932) and Gong Gui (7895 6311)]

[Excerpts] Taiyuan, 27 Jun--Reform and opening up have brought vigor and vitality to coal production in Shanxi Province, and opened up wide prospects. The 1986 gross raw coal output of the province was 221.8 million tons, accounting for one-fourth of the national gross raw coal output. In the 8 years between 1979 and 1986, 1,290,160,000 tons of raw coal were produced, exceeding the gross raw coal output in the 30 years between 1949 and 1978 by more than 100 million tons.

Since the 3rd Plenary Session of the 11th CPC Central Committee, the Shanxi Provincial Party Committee and provincial government have adhered to the general principle of reform, opening up and invigorating the domestic economy, and resolutely implemented the central strategic decision on building Shanxi into a base of energy resources, heavy industry and chemical industry, by adopting the measure of combining the efforts of the state, the collective, and the individual, with large, medium, and small-type coal mines in simultaneous operation. As a result, coal production has taken on a pleasing situation unprecedented in history. The gross coal output in 1986 increased by 126 percent over 1978, and was 82 times that of 1949.

Coal production in Shanxi Province is making healthy progress at unprecedented speed, and making contributions to easing the shortage of energy resources of the state. In 1986 alone, the province shipped 152.33 million tons of raw coal to 25 provinces (regions), an increase of 178 percent from 1978. In the same year, 4.89 million tons of high-quality coal from Shanxi were exported to Japan, France, the United Kingdom, and Italy.

/9738
CSO: 4013/78

NEI MONGGOL'S OUTPUT COULD DOUBLE IN THREE YEARS

HK301007 Beijing RENMIN RIBAO in Chinese 27 Jun 87 p 1

[Dispatch by Reporter Ao Teng (0277 7506): "Nei Monggol To Become China's Second Largest Coal Base"]

[Text] Hohhot, 26 June--"Nei Monggol, where cow and sheep dung was used as fuel for generations, has become the second largest coal base in China." Recently, in reviewing the achievements on the 40th anniversary of the founding of the Autonomous Region, an official of the People's Government of the Nei Monggol Autonomous Region informed the reporter of this sweeping change.

The annual raw coal production of Nei Monggol is 35 million tons, 97.2 times that when the autonomous region was founded. The proven coal deposits in Nei Monggol are 216.97 billion tons at present while the prospective deposits are 1,200 billion tons, ranking second in the country. The coal construction in the western part of Nei Monggol is more encouraging. The construction of Junggar and Dongsheng, two very big coal fields with proven coal deposits of 20.6 billion tons and 92.7 billion tons respectively are in full swing. It is projected that when these coal fields follow each other into operation 3 years from now, the production of raw coal in Nei Monggol will double the present volume.

Nei Monggol's coal resources are not only rich in deposits, but also good in the following ways. First, the coal fields are evenly distributed, extending all the way from the east to the west, that is from northeast China, through north China, to northwest China. Coal can thus be supplied to the neighboring fraternal provinces and cites after extraction. Second, the coal is easy to extract. The coal resources of Nei Monggol are shallow beneath the rock, and the coal strata are stable. Take Junggar, the largest coal field, as an example. The deposits lie at a depth of around 20 meters. Third, the coal is high in quality and complete in variety.

/12913
CSO: 4013/82

CHARACTERISTICS OF CHINA'S COAL MINE GAS PRESENTED

Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 4, 13 Apr 87 pp 23-27

[Article by Wang Tao [3769 3447]: "Preliminary Analysis of the Basic Geological Characteristics of China's Coal Mine Gas"]

[Text] Coal mine gas is a gas which is produced in coal seams and in the process of mining the coal bed, gas damp outbursts and explosions seriously threaten safe production in some mines. In recent years, many coal mine geology workers have considered this gas a geological entity and have combined research and geological research so that some new knowledge has been gained concerning the basic characteristics of coal mine gas geology. The author has based this article on the materials collected by the Ministry of Coal in compiling a national coal fire-damp geology map.

Uneven Distribution Is a Universal Law of China's Coal Mine Gas and Outbursts

Coal mine gas is a gas which flows readily, its distribution in coal seams is extremely complex and its characteristic of nonhomogeneity is also pronounced. The outburst nonhomogeneity of China's coal mine gas is primarily manifested in that on the surface it is divided into "areas" and in cross-section into "zones." From Table 1 it can be seen that the coal mines in North China, the Northwest, and East China and the Northeast north of the Chang Jiang are primarily low methane mines, and that the outburst mines in the 10 provinces of the south make up 53 percent of the total number of such mines nationally. In the South, where high methane mines and outburst mines predominate, outburst mines also are concentrated in Sichuan, Guizhou, Hunan, and Jiangxi. The outburst mines in these provinces are numerous, the intensity of outburst (62 particularly large-scale outbursts have occurred in these southern provinces, and the outbursts are high frequency (the number of outbursts in the four provinces accounts for almost 60 percent of the number of outbursts nationally). Furthermore, in these provinces the distribution of outburst mines is also relatively concentrated, for example the outburst mines in Jiangxi are almost all distributed in the Pingle Depression belt. In terms of their intensity, there are differences from place to place, for example in the midsection of the Pingle Depression (Fengcheng to Yinggangling mine) the outburst coal volume per 1 million tons of coal (unit: ton/million tons) in the Fengcheng mine area is 1.12, in the Bajing mine's Eqi mine it is 7.6, in the Xinhua mine's No 1 mine it is 21.3, and in Yinggangline mine it can reach 45.8.

Table 1. Statistics on National Unified Distribution and Key Mine Gas Materials for 1984

Name	Mine shaft rank			Outburst situation*	
	Low methane	High methane	Outburst	No. of outbursts	Esp. large outbursts
Beijing	12	1			
Hebei	35	12	4		
Shanxi	40	17	2		
Inner Mongolia	5	4	1		
Henan	23	11	14		
Shandong	46	1			
Anhui	9	3	6		
Jiangsu	16	2			
Shaanxi	19	7	2		
Gansu	14	3			
Ningxia	4	4			
Qinghai	2				
Xinjiang	7				
Northeast	74	84	25		
Hunan	6	6	6	3771	39
Yunnan	8	1		1	
Guizhou	8	8	14	286	2
Sichuan	15	10	20	1409	15
Jiangxi	4	3	12	587	6
Zhejiang		9	3	56	
Guangdong				230	
Guangxi				18	
Hubei				65	

*Contains general mine shafts

In China's coal mines, as the extraction depth increases, the volume of mine gas which emerges increases and the intensity and frequency of coal and gas outbursts increases correspondingly and the vertical division into zones becomes even clearer (Tables 2, 3).

Table 2. Statistics on Volume of Gas Welling Up on Recovery Work Surface of the Nanshan Mine of Guisheng Province's Donglin Mining Bureau

Deposit depth (m)	Relative volume of methane welling up (m^3/ton·day)			
	No. of points	Lowest	Highest	Average
50-150	10	4.4	11.4	8.2
150-250	51	2.5	21.7	10.3
250-350	12	5.5	40.7	13.4

Table 3. Statistics on Gas Over the Years at the Liangshan Mine in Sichuan

Level		+390				+280				+140			
Item / Mine name	No.	Gross volume of outburst coal (tons)	Average outburst intensity (tons/event)	Maximum outburst intensity (tons/event)	No.	Gross volume of outburst coal (tons)	Average outburst intensity (tons/event)	Maximum outburst intensity (tons/event)	No.	Gross volume of outburst coal (tons)	Average outburst intensity (tons/event)	Maximum outburst intensity (tons/event)
South mine	16	1777.5	111.1	730	24	7892	328.8	1920	0			
North mine	15	575.0	38.3	200	15	3373.7	224.9	900	8	3318	414.8	1668
All mines	31	2352.5	75.9	730	39	11265.7	288.9	1920	8	3318	414.8	1668

Diversity of Types Is a Clear Characteristic of China's Coal Mine Gas Geology

Through arranging the coal mine gas geology materials of the 30 years since the founding of the People's Republic of China, China's coal mine gas geological types can generally be divided into the following:

1. Depositional Type

This type includes two sub-types, i.e., coal seam gas and non-coal formed gas depositional sub-types.

Coal seam gas sub-type: The occurrence of gas in coal seams is primarily related to such depositional conditions as the coal seam itself (thickness, gas permeability, degree of development, and coal and coal rock constituents), the top and bottom of the coal seam and whether or not the lithic type of the surrounding rock and the coal series strata are continuous deposits and degree of erosion and the characteristics of the strata overlying the coal series strata. For example, the Ganzhongnan type of Jiangxi Longtan coal series: the strata is generally about 500 m thick, ratio of sand and mudstone is generally 0.2-0.6; the lithic character of the rock at the top and bottom of the coal seam are unitary, mostly sandy mudstone or mudstone with poor gas permeability, especially the Laoshanzhong sub-section mudstone which is on top of the coal seam, lithic character is uniform, it is very thick, and gas permeability is poor; the thickness of the coal seams in this depositional area are fairly large; after deposition of the coal-bearing rock series, basically deposition of early Triassic marine deposits continued. Therefore, the gas content of the coal seams in the mines subordinate to the Changcheng Mining Affairs Bureau in Jiangxi is high, and the coal and gas outbursts which have already occurred are clearly related to this depositional action and thus should be classed as depositional type. Although the coal seam in the Fushun Tertiary coal field is jet coal, the coal-bearing strata contains several tens of meters to over 100 meters thick coal seam, the top of the coal seam is 50-190 meters of brown oil shale and above that is 300-600 meters of calcium shale and shale and the bottom is basalt, oolitic siderite and brown claystone, above and below the coal seam are thick gas barriers, and although the degree of coalification of the coal is not high, because the closure conditions are good, there is much gas in this mine shaft, and it is a coal and gas outburst shaft, thus the gas is also controlled by sedimentation action.

Non-coal-formed gas sub-type: Characteristic is that the primary source of the gas in the coal mine shaft is not coal-formed gas, but is related to the oil gas in the surrounding rock, for example the gas in the coal mines in the Nadu district in the eastern part of the Baise coal field in Guangxi belongs to this sub-type.

2. Structural Types

The occurrence of the gas in this type of coal seam is primarily related to the geological structure. The geological structure has two areas of importance to the occurrence of the gas, i.e., its collection and its

release. This type generally can be divided into the fault sub-type and the fold sub-type.

Fault sub-type: Faults in a coal seam and the surrounding rock are channels for the enrichment and flow of gas and have both preservation functions and dispersal functions. The fault's dynamic nature, the lithic nature of the two plates, the occurrence of the coal seam all have an influence on the collection and dispersion of coal seam gas. For example, the Hongmao coal field in Guangxi (Carboniferous Ceshui coal series) developed on two wings of an anticline: the western wing's Maolan mine is rather far from the axis of the anticline, within the shaft field the piezotropy travels primarily toward the fault and the gas in the deep parts is not easily dispersed, the weathering belt of this mine's gas is only 47 meters, the volume of gas emerging from the mine shaft is 30-106 m^3/ton·day; but the Hongshan mine area of the eastern wing, within the shaft field there are many tension-twisted oblique faults, fault density is also great, and it is easy for the gas in the deep parts to disperse toward the shallow parts along the faults. This shaft's gas weathering belt is 250 meters and it is a low methane shaft.

Fold sub-type: The folds have a distinct influence on the distribution of gas, generally a large coal seam pitch is much more favorable for release of gas than a small pitch. This is primarily because of the permeability of the rock strata: the direction in horizontal strata is 3-10-fold higher than in vertical direction (Hunan Coal Institute materials). For example, the pitch of the southern wing of the Furong mine area in Sichuan is low, generally 6°-12°, the volume of gas that rises out is as high as 150 m^3/ton·day, and there are coal and gas outbursts; the pitch of the northwest wing is steep, generally 40°-80°, the volume of gas that wells out is 20 m^3/ton·day, and there have not been any coal and gas outbursts. In the Baisha syncline in the Matian mine areas in Hunan, the pitch of the western wing is slow, the gas content is high, and eastern wing is a steep slope, and the gas content is low. The influence of folds on gas in a coal seam sometimes also exhibits a transforming action on the coal seam, for example, changes in the thickness of a coal seam caused by folding and the impact on the coal body structure. In the Xinhua coal mine in Jiangxi, because of extrusion the coal seam on the anticline has become a thin and unminable zone; the coal seam on the syncline has become thick and formed a pocket. A second pocket in the eastern part is very thick, with a maximum thickness of 47 meters, and an average of 11.3 meters; the pocket exhibits hump and saddle shapes. At the No. 1 shaft which has severe outbursts, coal and gas outbursts occurred 103 times between 1961 and 1981, of which 78 were concentrated in the second pocket in the eastern section of this shaft. At the same time, due to the violent extrusion, a smooth structural surface was often formed in this coal seam, the mirror occurrence is basically uniform with the coal seam occurrence, dividing the coal seam into upper and lower sub-seams, the upper sub-seam is very easily smashed into powder, but the lower sub-seam is hard block coal. When the tunnel first entered the top coal (the upper sub-seam), coal and gas outbursts easily occurred; but when the rock arch uncovered the coal and first entered the lower coal, there were few outbursts. For this reason, digging in the coal tunnels in this mine is strictly restricted to the bottom coal, and through other anti-outburst measures, there has been only one small-scale outburst at this mine since 1981.

3. Magmatic Heat Metamorphic Type

The occurrence of gas in the coal seam is related primarily to the intrusion of magma into the coal seam or the area surrounding the mine. The Anyuan coal series coal seam mined in the Yongshan coal mine area in Jiangxi is typically developed magmatic heat metamorphic type. Because the coal seams within the mine area have been influenced by external heat rock formation, the metamorphic zones of coal from west to east are very distinct. The Yongshan mine in the western part is primarily anthracite, in the Yangou mine in the central part it is poor anthracite, and at the Xiancha mine in the eastern part it is primarily lean coking coal. Under the influence of this type of division into coal belts, the gas content in the coal seams in this mine area decreases from west to east and the tendency for the intensity of coal and gas outbursts to diminish is very clear (Table 4).

Table 4. Statistics on Gas Welling Up in Mine Areas

Mine name	Volume of gas (m^3/ton·day)	No. of outbursts	Maximum volume of outburst coal (tons)
Yongshan	24.49	56	2200
Yangou	13.80	22	1350
Xiancha	13.41	5	100

Because the coal seams in the Late Permian Longtan coal series in the southwest Fujian and eastern Guangdong area were subjected to the influence of igneous rock in the Yanshan and Yinzhi periods, the degree of coal metamorphosis increased to become highly metamorphic anthracite coal ($H^r \leq 2$ percent). Since the micropores in the coal seam suddenly became smaller and the mine shafts are mostly low methane shafts, this is the area of distribution of low methane shafts which are clearly characteristic of the western Fujian and eastern Guangdong.

4. Compound Types

The occurrence of gas in coal strata is the result of the compound action of two or more of the geological factors described above. For example, the Xuzhou Mining Bureau's Dahuangshan mine is a typical example of compound deposition and structural type. The Xuzhou mining district is situated in the southeast part of the Carboniferous-Permian jumei [5112 3561] area on the pre-Zhendan period North China table, the Dahuangshan shaft field is situated in the eastern part of this mine area, and in the field the Paleozoic group was subjected to Yanshan north-south movement and was extruded southeast and northwest forming a synclinal basin whose axis is toward the northeast. The eastern wing strata of this coal basin are steep and even turned over; the southwest wing is more gradual with a pitch generally of 30°-40°, forming an asymmetrical spoon-shaped syncline. The Shihezi group 3 coal group in the middle and bottom is the primary coal mining seam of this field, the sandy mudstone 3-10 m thick directly on top of this coal seam is low permeability rock. The distribution of gas on the coal seam recovery surface of mine field No. 3 relative to the volume welling out has the

characteristics of the shallow parts being high and the deep parts being low. The cause of this distributional characteristic is the result of the common action of structural and depositional geological factors: 1) the steep pitch of the coal seam, the development of joints and cracks in the coal seam caused by stress are favorable conditions for the gas to migrate upward; 2) the coal series outcrops are covered by basal low permeable thick Quarternary clay overlay which forms an excellent covering strata and prevents the gas from escaping so that it collects in the shallow parts; 3) the scope of this basin is small and shallow, and when mine shafts mine from the shallow to the deep parts from around the coal basin and the area which has not been mined contracts, it makes it easier for the gas in the deep parts to escape and so that the working surface relative to the volume of gas rising declines when the deep parts of the coal seam are mined.

Plate Edge Tectonics Are Important Structures for Controlling Gas and Outbursts in China's Coal Mines

China's coal and gas outbursts and high methane shafts are primarily distributed in four belts: northern Zhejiang, central Jiangxi, and south central Hunan; central Sichuan and eastern Guizhou; southern Jiangsu, southern Anhui, and southeast Hubei; western Liaoning, northern Hebei, and the southern part of Inner Mongolia. These four belts are situated exactly at the boundaries of Mr Li Chunyu [2621 2504 2509]'s divisions of China in his article "New Knowledge Concerning the Development of Asia's Geological Structures": the North China fold zone and the Yangzizhun platform, the Sanjiang-Dianmian trough and the Yangzizhun platform, the Qinling trough and the Yangzizhun platform and the Sino-Korean plate and the Tianshan-Mongolian-Taxingan Range trough. Clearly, coal and gas outbursts are closely related to plate tectonics. However, a large volume of materials show that plate edges are not everywhere favorable for gas occurrence in coal seams and the extremely easy production of coal and gas outbursts. Through reorganization and analysis of geological materials on gas in China's coal mines we discovered that terminal structures often are important geological structures which control production of coal and gas outbursts in shafts and tunnels and on work surfaces. Terminal structures refer to some small-scale secondary structures at the terminus of primary structures which control mine fields, such as the plunging end of an anticline, the restrained end of a syncline, the bent edge of the sudden changes which occur in a coal seam along the alignment or on a slope and the subduction zone of a fault stratum. The development of terminal structures normally is large changes in coal seam thickness, low strength of the coal seam, poor porosity of the coal seam, high gas pressure, and ground stress relative to the section, thus frequently it is the site where the volume of coal seam gas is large and gas outbursts constantly occur. For example, the Jiangxi Fengcheng Mining Bureau's Pinghu and Jianxin mines have in their shallow development the backbone fault F_4 fault stratum, which at the deep part of the mine shaft divides into several small scale branch faults (F_3-2a, F_3-2b, F_3-2c). In the process of digging a 400-meter transport tunnel, over 90 percent of the coal and gas outbursts were related with these branch faults, i.e., the subduction zone of the F_4 fault stratum. Or for another example, the Jiangxi Yinggangling coal mining area is a complex syncline which exhibits

east northeast development, this syncline is restrained on the east by the Jianshan mine and is unrestrained toward Wujia mine in the southwest, Jianshan mine, which is situated with the syncline, has characteristics of large volume of gas and coal and relatively severe coal and gas outbursts (Table 5).

Table 5. Statistics on Gas in Mine Shafts of the Yinggang Mine

Name	No. of outbursts	Gross vol. of outburst coal (tons)	Av. intensity of outbursts (tons/event)	Max. intensity of outbursts (tons/event)
Jianshan	104	5307.1	51	1000
Fenglin	61	2220	37	489
Qiao 1	28	515	18	100
Qiao 2	51	1050	20	300
Dongcun	1	8	8	8
Wujia	8	243	31	79

This paper received the enthusiastic guidance of Professor Yang Lisheng [2799 0500 3932] of the Jiaozuo [3542 0155] Mining Industry Academy, to whom we express our gratitude.

(Jiangxi Coal Field Geological Exploration Company)

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8226/6091
CSO: 4013/70

PROGRESS SEEN IN OIL-TO-COAL CONVERSION EFFORT

Beijing RENMIN RIBAO in Chinese 25 Jun 87 p 1

[Article by reporter Huang Fengchu [7806 1144 0443], Beijing, 24 Jun: "Investment Contract System Adopted To Speed Up Energy and Transportation Construction--Oil-to-Coal Conversion Office of State Council Reforms Management System--New Increases in Installed Capacities 5.66 Million kW; in Raw Coal Production 28 Million Tons]

[Text] Notable investment benefits have been obtained by the Oil-to-Coal Conversion Office of the State Council by utilizing economic means and by implementing an investment contract system.

Beginning from the early 1970s, China's oil-burning facilities increased greatly, and in 1980 the highest oil-burning peak was reached. In this one year, the amount of oil burned reached to more than 40 million tons, comprising approximately one-half of the petroleum consumption for the whole country. Not only is this an extreme waste of resources, it also creates a great loss economically. Calculating according to the present oil prices on the international market and in comparison with coal-burning, this is equivalent to burning up U.S. $5 billion more in 1 year. In 1981, the State decided to substitute coal for oil and to reduce oil burning. In the more than 6 years of time through 1986, the reduction in oil burning amounted to 24.8 million tons, 12.2 billion yuan in accumulated funds, and nearly U.S. $3 billion in generated foreign exchange. The State has stipulated that the funds saved under the coal substitution for oil would be given to the Oil-to-Coal Conversion Office to use for energy construction.

How are these funds to be used well and how is construction in energy, transportation and their related complements which use electricity as their focal point to be done well? The Oil-to-Coal Conversion Office of the State Council has taken the reform of its investment management system as a a point of departure and

has implemented an investment contract system, and it has issued programs and signed contracts. In these contracts, reasonable construction periods and investment quotas have been stipulated for oil reduction projects. Those completed on time will be given awards, and those completed ahead of schedule will be given double awards; those which stall must use their own funds to purchase high-price oil as compensation. Those which, due to subjective causes, exceed the budgetary estimates will foot the bill themselves.

Up through the end of 1986, the Oil-to-Coal Conversion Office of the State Council had altogether signed 214 contracts for oil reduction projects with departments, locales and enterprises. Of these, there are power plant construction projects with 5.66 million kW of additional installed capacities, mine construction projects with 28 million tons of additional raw coal production, and harbor construction projects with 25 million tons of increased handling capacity. Lumber production capacities of 700,000 tons and steel production capacities of 200,000 tons have come into being by rebuilding or enlarging forestry projects and steel mills. At the same time, several railroad transportation related projects have also been done.

Implementing the investment contract system has great advantages in avoiding unrestrained spending and healing "investment starvation." Comrades from the locales and enterprises have reported, "If we are to use the oil-to-coal money, we must first make computations and then spend. We cannot use it first and then make computations." Taking the electric power system as an example, in the investment contract system it clearly stipulates reducing the use of oil and building power sets with unit capacities of 300,000 kW in a construction period of 36 months. Now, a total installed capacity of these units reaching 2.09 million kW has already gone into production. The construction period is generally shorter, the fastest one going into production in 27 months. This construction period is much shorter than for similar types of power plants in the past. In the 5 years from 1982 to 1986, electric power departments overfulfilled the oil reduction plan by 6.22 million tons. As a result, they have obtained more than 180 million yuan in award money. They have used these monies to supplement production and development capital, to build a set of welfare facilities for the staff and workers, and to arouse enthusiasm for oil reduction at each level.

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CSO: 4013/85

BRIEFS

UNDERGROUND COAL GASIFICATION--Nanjing (CEI)--China has for the first time succeeded in underground gasification of coal. The new technique recently passed assessment conducted by 20 experts. With the new gasification technique, 95 percent of the deposits of a mine can be tapped, while the conventional method can only mine 40 percent of deposits underground. The experiment was jointly carried out by the China Mining Institute and the Xuzhou Coal Industrial Company on an abandoned coal seam in the Mazhuang coal mine near Xuzhou City. The experiment generated 160,000 cubic meters of coal gas in 3 months as scheduled, and every cubic meter of the coal gas, generated between April and May this year, produced a fuel value of 1,000 kilocalaries. [Text] [Beijing XINHUA in English 0555 GMT 22 Jul 87 OW]

NEI MONGGOL PRODUCTION--By the end of June, Nei Monggol's collieries whose products are distributed under unified state plan had produced some 4,166,300 tons of raw coal, or 51.3 percent of the annual target; their tunneling footage had reached 3,510 meters, 53.9 percent of the annual target. [Excerpt] [Hohhot Nei Monggol Regional Service in Mandarin 2200 GMT 5 Jul 87 SK] /9738

HUNAN MINE CONSOLIDATION--Our reporter has learned from a provincial conference which concluded on 5 July, that to promote continuous, steady, and healthy development of local coal mines, the provincial government has decided to consolidate small coal mines run by townships. Production and management in small coal mines has been chaotic over the past few years. According to statistics, of the province's some 6,000 coal mines run by townships, collectives, and individuals, more than two-thirds have not been officially approved. This has not only jeopardized the overall arrangement for mining coal but has also posed a serious threat to safety in large coal mines. To change this, the provincial government demanded that all localities pay equal attention to exploitation and safety in coal mines and lay equal stress on opening up the proper management. Small coal mines that have no mining licenses, do not conform to rules on accident-free production, vie with large coal mines for resources, and pose a serious safety threat should be closed down if necessary. The handful of small private coal mines that depend on plundering state resources and do not meet minimum requirements must be resolutely outlawed. [Summary] [HK070749 Changsha Hunan Provincial Service in Mandarin 0000 GMT 6 Jul 87] /12223

CSO: 4013/82

KANG SHIEN ON STATUS, FUTURE OF PETROLEUM INDUSTRY

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 20 Jun 87 p 1

[Article by Lu Jiazhong [0712 1696 0022] and Li Kefu [2621 0344 1133]: "Development in Near Future Will Stress Shengli Oil Field; State Councilor Kang Shien Talks With Reporters"]

[Text] State Councilor Kang Shien [1660 0013 1869] is currently directing the work of the Shengli oil field. During an interview with reporters from this paper, he gave a detailed explanation of the current status and prospects for China's petroleum industry. He disclosed that petroleum development in China in the near future will stress the Shengli oil field, which within 3 and a half years will have a stable output of 30 million tons and a potential further yield of 20 million tons, so could actually yield 50 million tons.

Kang Shien said that the petroleum industry is recognized worlwide as a risky business. Looking at the course of China's own petroleum development, we see that our land mass includes the continental shelf, and a constant problem has been that of being oil-deficient while resource-rich. In the 1950s, oil-deficient theories were predominant, even reaching the level "There is no oil or natural gas to be found in China." At that time, our technological level was backward, lacking expertise and experience, so how could oil be found in such a vast area? Under these difficult conditions, geologists such as Li Siguang [2621] 0934 0342] engaged in a desperate search for oil. They were convinced that there was oil in China, but due to the barriers thrown up by conditions, this knowledge remained theoretical. it was not until the 1960s, with the discovery of the Daqing oil field, that this question of oil-deficiency was resolved.

Opening up the Daqing oil field had an enormous effect on the development of China's petroleum industry. After Daqing was opened, the oil-deficiency theories appeared again: "China's petroleum has dried up," and "China's yield of crude oil will drop from 100 million tons to 80 million tons and then to 50 million tons." According to these theories, China would revert to

to an oil-importing nation. But some of our people would not admit to "defeat." By 1964, oil exploration had turned to the Bohai Bay basin. The geological conditions there were much more complex than those at the Songliao basin: when the rifts of ancient and later periods were interlocked, it looked like a dish which has been smashed into pieces and then kicked around. The area of East China lay in a fault group, forming multi-layered strata, several geologic periods, and many varieties of complex layers of oil and gas.

This presented enormously difficult problems. By what means could such complex oil and gas layers be found? Kang Shien told the reporters that the means used to find the Shengli oil field--rolling exploration and development--had raised the success rate of well drilling steadily. This included the offshore, Liaohe, Dagang, North China, and Zhongyuan oil fields, and the areas of southern Hebei which are similar. In this way, the prospects for petroleum development were opened up tremendously.

Councilor Kang Shien said that through its own hard work, the Shengli oil field digested the world plate [tectonics ?] theories, leaping forward in technology and expertise. It was previously estimated that in the region of East China there could possibly be 10 billion tons in petroleum deposits, with an annual output of 10 million tons of crude oil; now, Shengli oil field alone has deposits of 5 billion tons, and its output could reach 50 million tons annually, far surpassing original estimates.

When reporters inquired about China's petroleum development emphasis in the near future, he said that now and to the end of this century our focal point will still be the Bohai Bay region.

Is this to say that the western regions are unsatisfactory? No, in recent years, petroleum exploration in the west has made great breakthroughs through the use of plate theories. Prospects for petroleum development in the west will burgeon and it will be a great oil field in the future.

In brief, China's petroleum yield by 1990 will be 150 million tons, with annual output reaching 250 million tons by the year 2000. Only then will it be possible to meet the needs of the domestic market, without resorting to imports.

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CSO: 4013/84

MPI OFFICIALS OPTIMISTIC, PREDICT STEADY GROWTH

HK151102 Hong Kong ZHONGGUO XINWEN SHE in Chinese 1004 GMT 14 Jul 87

[Report by Xu Yuming (6079 3768 2494): "China's Oil Production Shows Bright Prospects in the First Half of This Year"]

[Text] Beijing, 14 July (ZHONGGUO XINWEN SHE)--China's oil industry continued to grow in the first half of this year, and much headway has been made in tapping oil and natural gas and exploring and developing oil and natural gas fields.

In the first half of the year, China produced a total of 65.27 million tons of crude oil and 7 billion cubic meters of natural gas, representing increases of 4 and 3.2 percent respectively over the same period last year. Some 2,000 new wells in 16 oil fields have been put into operation, adding more than 2.3 million tons of production capacity to these oil fields. Production in the old oil fields, which produce more than 90 percent of China's crude oil, has been steadily increased, and the annual growth rate of the water content of oil has been reduced. Officials of the Ministry of Petroleum Industry are optimistic about the fulfillment of this year's crude oil and natural gas production plans.

Through explorations over many years, China's oil and natural gas production has entered an inspiring period of momentous discovery. Recently, a large oil field has been discovered in the east of the Junggar Basin in Xinjiang. At present, in the exploration area covering 24,000 square kilometers, five crude oil depressions and four oil and gas aggregation areas have been discovered. The oil layer is about 100 meters thick. Experts hold that this is another oil field with rich oil and gas reserves after the Karamay oil field, and a new oil area of great economic value, with its shallow oil layer easily explored.

In the Gasikule oil field in Qinghai's Qaidam Basin, efforts are being made to speed up development and construction. At the same time, some new high-yield wells have been sunk in the neighboring areas. Thus, the oil production area has been expanded.

In the Tarim Basin, the largest basin in China, it has been proven through initial explorations that there are thick reserve beds and that their

structures are good for exploration. This area is now regarded as a treasure house in which large or extra large oil and gas fields may possibly be found.

Recently, China has also found some large oil-bearing areas in the Bhai and Songliao Basins. The oil and gas reserves of China's main oil fields have been greatly increased from their original level.

Officials of the Ministry of Petroleum Industry hold that a situation of steady growth will appear in China's oil and natural gas production. By 1990, its crude oil output will reach 150 million tons.

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CSO: 4013/81

RICH OIL AND GAS RESOURCES FOUND IN NANSHA ISLANDS

HK300309 Beijing RENMIN RIBAO in Chinese 24 Jul 87 p 3

[Report: "Survey Team of Chinese Academy of Sciences Discovers Rich Oil and Gas Resources in Zengmu Ansha Basin"]

[Text] According to a report carried by today's KEXUE BAO, the Nansha Islands of our country are not only rich in natural resources and precious marine resources but also rich in oil and gas resources. This is the conclusion reached by the survey team of the Chinese Academy of Sciences, which carried out a survey of the Zengmu Ansha Basin in May of this year.

In the Nansha Islands' area of 2.1 million square kilometers, there are over 230 islands, reefs, beaches, and shoals. The South China Sea Research Institute, under the Chinese Academy of Sciences, has been continuously and comprehensively surveying this area since 1984. The results of the survey have filled the gaps in China's scientific research on the southern border area. The survey team of the Chinese Academy of Sciences used a variety of advanced equipment and instruments in carrying out the survey and finally established the actual topography, general configuration of the reefs, and the geographical location of Zengmu Ansha and Baxian Ansha and produced maps of the area as well. Through the survey and research, the survey team of the Chinese Academy of Sciences has become very knowledgeable about this environment and about the variety, formation, and distribution of organisms at Zengmu Ansha and neighboring areas and has also discovered dozens of new marine organisms in that area. On 10 April of this year, on the basis of this achievement, the Chinese Academy of Sciences sent two more survey ships, Experiment 2 and Experiment 3 to the southern border area to carry out scientific surveys and investigations. The two ships carried out surveys of the Nansha Islands area for a month and a half.

During its survey and investigations, the Experiment 2 survey ship obtained a large amount of geophysical materials, which are presently under intensive study. In carrying out its survey, the Experiment 2 also discovered some important phenomena of geographical structure and the characteristics of the distribution of sea mountains and of magnetic anomaly. The preliminary analysis of the relevant materials has shown that on the continental shelf to the north of Zengmu Ansha there exists a big sedimentary basin, which covers an area of more than 90,000 square kilometers and has a rich reserve of oil and gas.

The Experiment 3 carried out scientific surveys and investigations of 10 reefs north of the Nansha Islands, including the Pengbo Ansha and the Xianbin areas. The survey team also placed signs, which read "Erected by the Nansha Islands Survey Team of the Chinese Academy of Sciences," on every reef it surveyed.

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CSO: 4013/88

LIAOHE FIELD ENTERS GOLDEN AGE OF EXPLOITATION

HK241220 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0110 GMT 20 Jul 87

[Text] Shenyang, 20 July [ZHONGGUO XINWEN SHE]--The Liaohe oil field, located in the Liaohe Plain in the northeast, one of China's large oil production bases, has entered the golden age of oil exploitation.

Its daily output of crude oil is 30,000 metric tons or more, a record high. It is estimated that its output will reach 11.4 million metric tons this year, or a net increase of 1.4 million metric tons over the previous year.

The Liaohe oil field formally started operation in 1970. In the last few years, it has implemented a pattern of "rolling exploitation" under which prospecting, construction, and production are carried out simultaneously, thus increasing its crude oil output at a rapid rate of 1 million metric tons or more a year since 1982. It has now become the third largest oil field in China.

Several tens of thousands of oil workers and technicians who are working vigorously in an area of more than 900 square kilometers covering the middle and lower reaches of the Liao He have discovered a large batch of high-yield oil-gas-rich zones and new oil-bearing formation systems in the verified old oil zones. They have ascertained there is a "composite oil-gas pool" zone in this area belonging to a multilayer oil pool system, and thus opened up a vast zone of oil exploitation in the Liao He region. At the same time, crude oil prospecting has been expanding northward and westward to Tieling, Fuxin, Chaoyang, the peripheral districts of Gukai in Nei Monggol, and to the coastal areas in the southwestern region. The prospecting has successively produced findings of value, opening up a captivating prospect for the Liaohe oil field. In addition, major breakthroughs have been made in the technology to exploit thick oil, thus paving the way for exploiting the dense oil resources, which constitute more than 30 percent of the area's crude oil reserves.

According to the estimates of interested people, the area's crude oil output will top 15 million metric tons in 1990.

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CSO: 4013/88

OPEN POLICY PAYS OFF FOR PETROLEUM CORPORATION

OW221047 Beijing XINHUA in English 0818 GMT 22 Jun 87

[Text] Tianjin, 22 Jun (XINHUA)--The utilization of foreign funds and close overseas cooperation have helped the Tianjin-based Bohai Petroleum Corporation of China finish more work since 1980 than during the previous 15 years.

A corporation official said that his corporation, the first Chinese offshore oil company, has completed 70,000 kilometers of seismic lines, discovered 14 oil-bearing formations and drilled 108 offshore oil wells since it began cooperating with foreign companies to explore and develop the Bohai Sea oil field in 1980.

Now, the Chengbai oil field in the Bohai Sea, developed under a Sino-Japanese cooperation plan, has started commercial production, the official said, adding that another two Sino-foreign joint-development oil fields will go into operation in a couple of years.

The corporation has earned 500 million U.S. dollars-worth of hard currency over the past 7 years by offering labor services and contracting for engineering projects.

"Through joint exploration and development, we've learned and mastered many items of advanced foreign technology," the official said. The corporation now has met or approached the highest international standards in 20 key techniques, including offshore positioning, telemetering, geophysical surveys, well drilling and oil extracting.

Thanks to the introduction of foreign technology, the corporation has built 11 drilling rig frames up to advanced international standards. Last year, the corporation's frames won a quality reliability certificate from the American Bureau of Shipping.

"Overseas cooperation has also helped us train competent workers," the official said. Since 1983, the corporation has sent two groups of senior technicians to work in foreign oil companies.

As a result of technical training and guidance from foreign experts, 571 of the corporation's employees have received certificates showing that they are capable of operating in line with international standards.

Through cooperation with foreign firms, the corporation has also streamlined its managerial systems of research, design, construction and test assessments.

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CSO: 4010/63

SHENGLI OUTPUT SAID TO INCREASE SUBSTANTIALLY

SK230655 Jinan Shandong Provincial Service in Mandarin 2200 GMT 22 Jun 87

[Text] Adhering to the principles of reform and opening up, through scientific, realistic, and arduous efforts the Shengli oil field has effected substantial increase in crude oil output year after year. Last year its crude oil output totaled 29.5 million tons, a 51.5 percent increase over the 1978 figure. Over the past eight years, it has accumulatively produced 167 million tons of crude oil, 44 million tons more than the total output from 1965 to 1978, thus becoming the second largest oil field in China.

Since the 3d Plenary Session of the 11th Party Central Committee and since 1981 in particular, the vast number of petroleum industrial workers have conscientiously plunged into practice and constantly summed up experiences. As a result, they have discovered some rich oil deposits in some locations considered as having no possibilities for producing oil. With the 21 newly discovered oil fields, the total number of oil fields has reached 55. Meanwhile, the Shengli oil field has discovered several billion tons of petroleum deposits and tens of billions cubic meters of natural gas, and has basically provided itself with petroleum resources for a 50 million ton production capacity.

In the course of development and construction, the Shengli oil field has grasped the stable production of the old oil fields with one hand and the development of new oil fields with the other. For the old oil fields which were exploited many years ago, comprehensive readjustment and water injection have been strengthened, thus making more than 20 old oil fields basically achieve a stable and high output. At the same time, the opening up of new oil fields has also been accelerated. In only nine months last year, the development of the Gudong oil field was completed, which put more than 900 oil wells into production and produced 3.2 million tons of crude oil last year.

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CSO: 4013/81

MORE OIL DISCOVERED IN BOHAI SEA

OW151158 Beijing XINHUA in English 1150 GMT 15 Jul 87

[Text] Beijing, 15 Jul (XINHUA)--China has struck oil in 130 square kilometers of Liaodong Bay in the Bohai Sea, the China National Offshore Oil Corporation announced today.

The "Suizhong 36-1" oil-bearing stratum is the second to be discovered in the Bohai Sea, a corporation spokesman told XINHUA.

The corporation has already drilled two wells in the area, which is rich in oil and gas deposits, and claimed a major breakthrough in independent offshore oil prospecting.

Testing was completed early this month on the second well, at a depth of 2,425 meters, and 1,400 barrels of oil are being pumped daily from a depth half the stratum's 163 meters.

The first well yields about 1,000 barrels of oil and 199,000 cubic meters of natural gas a day.

Discovery of the area's two oil-bearing strata, "Suizhong" and "Jinzhou," show good potential for gas and oil development in Bohai's Liaodong Bay, the spokesman said.

The "Jinzhou 20-2" region is 50 kilometers southwest of Jinxi County, Liaoning Province, and 25-30 meters underwater. Since locating this stratum in October 1984, nine wells have been drilled, of which eight are oil-bearing.

Large oil deposits in the Bohai Sea have drawn the attention of the Chinese Government, and the corporation has plans to accelerate oil prospecting in Liaodong Bay.

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CSO: 4010/63

NEW OIL WELL OPERATIONAL IN BEIBU GULF

OW150742 Beijing XINHUA in English 0732 GMT 15 Jul 87

[Text] Guangzhou, 15 Jul (XINHUA)--A new oil well with a daily output of 1,100 cubic meters has gone into operation recently at the Wei-10-3 oil field opened up in cooperation with Total of France in Beibu Gulf in the South China Sea, XINHUA learned today.

Drilling of the 2,190-meter-deep oil well began in March this year. This is the seventh oil well in operation at the Wei-10-3 oil field. The operation of the new well will enable the oil field to meet its annual target of 2.25 million bbl of oil, said an official of the old field.

But more significant is that it has been found that the oil strata are becoming thicker toward the east, thus promising well in ensuring a long, stable high output, the official said.

The Wei-10-3 oil field began production on August 7 last year and production has been satisfactory, the official said. By the end of June this year, it had produced 2.1 million bbl although it had to stop production for 32 days in May owing to a tanker breakdown.

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CSO: 4010/63

BRIEFS

GUANGXI OIL WELL--Beijing 2 July (XINHUA)--According to the Ministry of Petroleum Industry, another high-yield oil well was recently sunk in Guangxi's Baise Basin. Completed in March, the well is 2,003 meters deep and can produce 418 metric tons of crude daily. It is reported that oil for industrial use has been found in seven of the eight oil wells drilled in the past year or so in the basin. [Summary] [Beijing XINHUA Domestic Service in Chinese 0642 GMT 2 Jul 87 OW] /12913

SHAANXI DRILLING PROJECTS--Xi'an, 23 June (ZHONGGUO XINWEN SHE)--The Shaanbei field, located in Ansai, Shaanxi, began drilling a few days ago. The Shaanxi-Gansu-Ningxia Basin abounds in oil resources. The proven oil deposits of the Shaanbei oil field total over 100 million tons. In addition, the zone extending from Yimeng to Fuxian has rich reserves of natural gas. The drilling of 100,000 cubic meters undertaken by the Xibei Geological Prospecting Bureau under the Ministry of Nuclear Industry started last month. The gas well drilling project of the Changqing oil field drilling company is now underway. Last year the company sunk six wells in northern Shaanxi's Zizhou, Suide, and Yulin counties, five of which produced gas. The company has planned to drill another 17 gas wells this year. [Excerpts] [Hong Kong ZHONGGUO XINWEN SHE in Chinese 0358 GMT 23 Jun 87 HK] /12913

NEW SOUTH CHINA SEA WELL--A new well with a daily output of 7,182 barrels of crude at No. 103 field in the South China Sea has been put into operation recently. This high-yielding well is the seventh producing well drilled during the trial production period in the No. 103 oil field. Through tests this well, with a depth of 2,910 meters, has been proved to have a relatively thick oil layer together with fine gas-oil shows and high-yielding industrial oil resources. With this oil well going into operation, the Sino-French joint operation at No. 103 oil field is furnished with a new source of crude oil, laying a solid foundation for steady output of crude at the field and further showing the promise for exploiting oil resources in the South China Sea. [Excerpts] [Haikou Hainan Island Service in Mandarin 1000 GMT 9 Jul 87 HK] /9738

DAQING TOPS TARGET--As of the end of June 1987, the accumulated crude oil output of the Daqing oil field reached a total of 27,507,400 tons, and the field overfulfilled its first-half production plan by 84,700 tons of crude oil. Of this output, that of the periphery wells reached 635,000 tons, an almost 40 percent increase over the figure of the corresponding period in 1986. [Excerpts] [Harbin Heilongjiang Provincial Service in Mandarin 2100 GMT 2 Jul 87 SK] /12913

OIL ZONE FOUND--Beijing, 3 July (XINHUA)--A new oil zone has been found in the east Junggar Basin in the Xinjiang Uygur Autonomous Region, the ministry of petroleum industry announced here today. The zone, 170 km from the regional capital of Urumqi, has convenient transport facilities and its rich oil- and gas-bearing strata is near the surface. Geologists have discovered five oil segments and five structures there. Before finding the new zone, the official said, geologists had concentrated on prospecting in the central part of the Junggar Basin. They had discovered a 47-sq km oil zone including an oil-bearing stratum up to 45 meters thick with verified reserves of 700 million bbl and a large oil- and gas-bearing zone. Oil was found in an experimental well sunk this year, according to the official who is optimistic about prospecting in the basin. The ministry plans to develop the oil field to the same production capacity as the Karamay oil field, also in Xinjiang. According to an early report, the Karamay oil field produced 31.5 million bbl in 1984, ranking fourth in the country. [Text] [Beijing XINHUA in English 1353 GMT 3 Jul 87 OW] /12913

YENAN GAS STRUCTURE--Zhengzhou, 4 Jul (XINHUA)--Geologists have discovered a high pressure gas-bearing stratum in Henan Province. A test on an experimental well in the Gucheng Oil Zone in the Nanyang Basin showed that it discharges 133,000 cubic meters of natural gas a day. The new gas-bearing stratum was found between 619 meters and 623 meters underground. Prospecting and drilling began this year in the Gucheng Oil Zone, which is part of the Henan oil field, China's eighth-largest. [Text] [Beijing XINHUA in English 0817 GMT 4 Jul 87 OW][/6662

NEW OIL WELL TAPPED IN BEIBU GULF--Beijing, 27 Jul (XINHUA)--An oil well producing 944,000 cubic meters of natural gas, 1,320 barrels of condensate oil, and 1,484 barrels of crude oil daily has been tapped in the Beibu Gulf, the China National Offshore Oil Corporation announced today. Officials of the corporation speak highly of the finding of "Wei 6-1-1", which was drilled by China. Oil companies from Japan and the United States, in collaboration with China, have been drilling in the region, so far without success. "The new well proves the region is rich in oil and could be another important oil-producing region," an official said. "Wei 6-1-1" is located in a depression of the gulf, and exploration of the depression showed a high probability of oil reserves. A Sino-French oil field 27 kilometers northwest to the newly drilled well was put into test production last August and has gushed 310,000 tons of oil. Now the China National Offshore Oil Corporation is preparing to explore another field in the region. [Exceprts] [Beijing XINHUA in English 1437 GMT 27 Jul 87 OW]

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CSO: 4010/65

BRIEFS

NNSA ISSUES LICENSE--Beijing, 6 July (XINHUA)--China's National Nuclear Safety Administration (NNSA) today issued a licence to the Guangdong Nuclear Power Joint Venture Co. for part of the construction of a nuclear power plant, an administration official announced here today. It is learned that the construction will soon start on the infrastructures of two pressurized-water reactors, each having a generating capacity of 900,000 kW, at Daya Bay in Guangdong Province. On 7 January this year, the Guangdong Nuclear Power Joint Venture Co. presented NNSA with an application for the construction of part of its nuclear power plant, a report on safety analysis and an outline of quality assurance. According to China's management regulations on safety supervision of civil nuclear facilities, the provisional regulations on approving the safety of the Guangdong nuclear power plant, and the detailed rules for the issuing of a safety licence to a nuclear power plant, NNSA organized more than 100 experts to examine the presentations carefully. After examination, NNSA considered all the presentations to be in line with the state laws and regulations, and the construction to accord with the regulations on nuclear safety, especially in regard to environmental safety. [Text] [Beijing XINHUA in English 1338 GMT 6 Jul 87 OW] /12913

CSO: 4010/64

SCIENTISTS EXPLORE EXTREME COLD AS ENERGY SOURCE

Beijing KEJI RIBAO in Chinese 7 May 87 p 1

[Article by Zhang Yan [1728 3543]: "Possibility of Extreme Cold as New Energy Source Being Verified; Research Project To 'Increase Use of Extreme Cold as Low-Temperature Energy Source' Will Enter Large-Scale Experimentation and Expanded Production in November"]

[Text] To most people, extreme cold normally means trouble and hardship, but researchers at the Chinese Academy of Science's Genetics Institute look upon it as they do the sun, as an energy source that can be utilized. This new viewpoint is being verified in their experiments.

The experimentation includes using very cold regions' winter low temperatures to carry out low-temperature drying and breakage, concentration, breeding, storage and transport, etc. Among those working on the technology of using low temperatures to freeze-dry potatoes in powder form are this institute and the Bashang Agricultural Institute in Hebei's Zhangjiakou area, in a cooperative developmental research project to "increase the use of extreme cold as a low temperature energy source." This has gone through intermediate testing, and in November will be put into wider production, testing, and popularization.

Low temperatures can be widely applied in industrial and agricultural production, but to obtain low temperatures by artificial methods not only requires a large investment with a possibility of high waste, but is subject to obstacles from technological and siting conditions. Therefore, research personnel realize that low temperatures should be used under conditions as totally natural as possible. In this regard, the level of significance is the same as when making full use of solar energy.

Taking as an example the process of turning fresh potatoes into dried potatoes, and using the usual drying process methods, it takes 500 kg of firewood or more than 200 kg of bituminous coal to dry a ton of potatoes. If drying by naturally low temperatures is used instead of the usual methods, there will be a savings on energy, and the powder produced will have a better color and luster. It will reconvert better to liquid, with its nutritional components more effectively retained.

In a report on the possibility of using extremely cold temperatures, researchers stressed that there are 38 cities in China in which the coldest month's average temperature is below 9 degrees Centigrade. The areas of extreme cold are relatively widespread, and over a longer timespan. Working out methods which are suitable to natural conditions of this sort can turn a negative factor into a positive one, and will undoubtedly bring excellent economic benefits in production and construction.

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CSO: 4013/84

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